

What is claimed is:

1. A combination for use in aligning the filament of a flashlight lamp bulb with the principle axis of a flashlight reflector, the combination comprising:

5 a lamp bulb having a bulb portion, a pair of electrodes and a filament extending between the electrodes;

10 a lamp base adapted to receive the electrodes of the lamp bulb, the lamp bulb being secured to the base so that the electrodes extend through the base, the bulb portion is disposed adjacent the base, and the filament of the lamp bulb is aligned with a predetermined axis extending through the base, and wherein the base is

15 configured to be removably seated in a bore provided in a base receiver mounted adjacent to a forward end of the flashlight so as to align the predetermined axis of the base with the principal axis of the reflector.

20 2. A combination according to claim 1, wherein the lamp bulb comprises a bi-pin lamp bulb.

3. A combination according to claim 1, wherein the lamp base comprises a ceramic material.

4. A combination according to claim 1, wherein the lamp base comprises a solid of revolution with two holes
5 extending through the base in a direction of the axis of revolution.

5. A combination according to claim 4, wherein the predetermined axis is the axis of revolution.

6. A combination according to claim 4, wherein the lamp base generally comprises a frustum of a right circular
10 cone having a base end, a truncated end, and a tapered sidewall interposed between the two.

7. A combination according to claim 6, wherein the lamp bulb is secured to the lamp base adjacent the base
15 end.

8. A combination according to claim 6, wherein the sidewall is tapered at an angle of between 5° and 60° with respect to the axis of revolution.

9. A combination according to claim 6, wherein the sidewall is tapered at an angle of between 5° and 20° with respect to the axis of revolution.

10. A combination according to claim 6, wherein the
5 predetermined axis is the axis of revolution.

11. A combination according to claim 1, wherein the filament is aligned so that its center is displaced 0.003 inches or less from the predetermined axis.

12. A combination according to claim 1, wherein the
10 filament is aligned so that its center is displaced 0.001 inches or less from the predetermined axis.

13. A combination according to claim 1, wherein the lamp bulb is secured to the base with an adhesive.

14. A combination according to claim 1, wherein the
15 center of the filament of the lamp bulb is aligned with predetermined axis.

15. A combination for use in aligning the filament of a lamp bulb with the principle axis of a reflector, the combination comprising:

5 a bi-pin lamp bulb having a bulb portion, a pair of electrodes and a filament extending between the electrodes;

10 a lamp base comprising a conical frustum having a circular base end, a circular truncated end parallel to and concentric with the base end, and a conical-shaped side wall interposed between the two, the lamp base further including two holes extending through the base in a direction parallel to an axis extending through the center of the base end and truncated end and adapted to receive the electrodes of the lamp bulb;

15 wherein the lamp bulb is secured to the base so that the electrodes extend through the base, the bulb portion is disposed adjacent the base, and the filament of the lamp bulb is aligned with the axis.

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16. A combination according to claim 15, wherein the lamp base comprises a ceramic material.

17. A combination according to claim 15, wherein the lamp bulb is secured to the lamp base adjacent the base
5 end.

18. A combination according to claim 15, wherein the sidewall is tapered at an angle of between 5° and 60° with respect to the axis.

19. A combination according to claim 15, wherein the
10 sidewall is tapered at an angle of between 5° and 20° with respect to the axis.

20. A combination according to claim 15, wherein the filament is aligned so that its center is displaced 0.003 inches or less from the axis.

15 21. A combination according to claim 15, wherein the filament is aligned so that its center is displaced 0.001 inches or less from the axis.

22. A combination according to claim 15, wherein the lamp bulb is secured to the base with an adhesive.

23. A combination according to claim 15, wherein the center of the filament of the lamp bulb is aligned with the axis.

24. A flashlight comprising:
a barrel for retaining one or more batteries, the barrel having first and second ends;
a head assembly mounted to the first end of the barrel, the head assembly including a reflector and lens mounted in a mutually fixed relationship, the reflector including a central opening surrounding the principal axis of the reflector;
a lamp bulb having a filament extending between two electrodes;
a lamp base, the lamp bulb being secured to the base so that the lamp bulb is disposed adjacent the base and the filament of the lamp bulb is aligned with a predetermined axis extending through the base;

5 a lamp base receiver mounted adjacent the first
end of the barrel, wherein the lamp base is
removably seated in a complementary bore
extending through the lamp base receiver, and
wherein the lamp base receiver is mounted
adjacent the first end of the barrel so that
the lamp bulb extends through the central
opening in the reflector and the predetermined
axis of the lamp base is aligned with the
principal axis of the reflector;
10 a tail cap at the second end of the barrel;
an electrical circuit coupling the electrodes of
the lamp bulb to the one or more batteries; and
a switch interposed in the electrical circuit.

- 15 25. A flashlight comprising:
a barrel for retaining one or more batteries, the
barrel having first and second ends;
a head assembly mounted to the first end of the
barrel, the head assembly including a reflector
and lens mounted in a mutually fixed
20 relationship, the reflector including a central

opening surrounding the principal axis of the reflector;

a lamp bulb having a pair of electrodes and a filament extending between the electrodes;

5 a lamp base adapted to receive the electrodes of the lamp bulb, the lamp bulb being secured to the base so that the electrodes extend through the base, the lamp bulb is disposed adjacent the base, and the filament of the lamp bulb is aligned with a predetermined axis extending through the base;

10 a lamp base receiver mounted adjacent the first end of the barrel, wherein the lamp base is removably seated in a complementary bore extending through the lamp base receiver, and wherein the lamp base receiver is mounted adjacent the first end of the barrel so the lamp bulb extends through the central opening in the reflector and the predetermined axis of the lamp base is aligned with the principal axis of the reflector;

20 a tail cap at the second end of the barrel;

an electrical circuit coupling the electrodes of
the lamp bulb to the one or more batteries; and
a switch interposed in the electrical circuit.

26. A flashlight according to claim 25, wherein the

5 lamp bulb comprises a bi-pin lamp bulb.

27. A flashlight according to claim 25, wherein the
lamp base comprises a ceramic material.

28. A flashlight according to claim 25, wherein the
lamp base comprises a solid of revolution with two holes
10 extending through the base in a direction of the axis of
revolution.

29. A flashlight according to claim 28, wherein the
predetermined axis is the axis of revolution.

30. A flashlight according to claim 28, wherein the
15 lamp base generally comprises a frustum of a right circular
cone having a base end, a truncated end, and a tapered
sidewall interposed between the two.

31. A flashlight according to claim 30, wherein the lamp bulb is secured to the lamp base adjacent the base end.

32. A flashlight according to claim 30, wherein the sidewall is tapered at an angle of between 5° and 60° with respect to the axis of revolution.

33. A flashlight according to claim 30, wherein the sidewall is tapered at an angle of between 5° and 20° with respect to the axis of revolution.

34. A flashlight according to claim 30, wherein the predetermined axis is the axis of revolution.

35. A flashlight according to claim 25, wherein the filament is aligned so that its center is displaced 0.003 inches or less from the predetermined axis.

36. A flashlight according to claim 25, wherein the filament is aligned so that its center is displaced 0.001 inches or less from the predetermined axis.

37. A flashlight according to claim 25, wherein the lamp bulb is secured to the base with an adhesive.

38. A flashlight according to claim 25, wherein the head assembly is mounted to the first end of the barrel so that the principal axis of the reflector is coincident with the axis of the barrel.

39. A flashlight according to claim 25, wherein the head assembly is removably coupled to the first end of the barrel and the switch is adapted to close the electrical circuit in response to axial movement of the head along the barrel and to open the electrical path in response to axial movement of the head in the opposite direction.

40. A method of manufacturing a lamp bulb and lamp base combination, the method comprising:

obtaining a lamp bulb having a bulb portion, a pair of electrodes extending from the bulb portion, and a filament extending between the electrodes within the bulb portion;

inserting the lamp bulb into a lamp base adapted to

receive the electrodes of the lamp bulb until the

bulb portion of the lamp bulb is adjacent the
base and the electrodes extend through the base,
the lamp base being adapted to permit lateral
movement of the bulb portion and electrodes with
respect to a predetermined axis extending through
the lamp base;

laterally adjusting the lamp bulb with respect to the
predetermined axis of the base until the filament
of the lamp bulb is aligned with the
predetermined axis;

securing the lamp bulb to the lamp base to preserve
the alignment of the filament with the
predetermined axis.

41. A method according to claim 40, wherein the base
is configured to be removably seated in a bore provided in
a base receiver mounted adjacent to a forward end of a
flashlight so as to align the predetermined axis of the
base with the principal axis of a reflector of the
flashlight.

42. A method according to claim 40, wherein the lamp
bulb comprises a bi-pin lamp bulb.

43. A method according to claim 40, wherein the lamp base comprises a ceramic material.

44. A method according to claim 40, wherein the lamp base comprises a solid of revolution with two holes
5 extending through the base in a direction of the axis of revolution.

45. A method according to claim 44, wherein the predetermined axis is the axis of revolution.

46. A method according to claim 46, wherein the lamp
10 base generally comprises a frustum of a right circular cone having a base end, a truncated end, and a tapered sidewall interposed between the two.

47. A method according to claim 46, wherein the lamp bulb is secured to the lamp base adjacent the base end.

15 48. A method according to claim 46, wherein the sidewall is tapered at an angle of between 5° and 60° with respect to the axis of revolution.

49. A method according to claim 46, wherein the sidewall is tapered at an angle of between 5° and 20° with respect to the axis of revolution.

50. A method according to claim 46, wherein the
5 predetermined axis is the axis of revolution.

51. A method according to claim 40, further comprising laterally adjusting the lamp bulb until the center of the filament is displaced 0.003 inches or less from the predetermined axis.

10 52. A method according to claim 40, further comprising laterally adjusting the lamp bulb until the center of the filament is displaced 0.001 inches or less from the predetermined axis.

15 53. A method according to claim 40, further comprising securing the lamp bulb to the base with an adhesive.

54. A method according to claim 40, further comprising securing the lamp bulb to the lamp base with a UV curing adhesive.

55. A tail cap assembly for a flashlight having a barrel with a forward end and a rearward end, the tail cap assembly comprising:

a tail cap comprising a first body portion having a first end and a second end and being adapted to removably engage the interior of the flashlight barrel at the rearward end, a second body portion attached to the second end of the first body portion and being adapted to enclose the rearward end of the flashlight barrel when the first body portion engages the barrel, and a spring seat at the first end of the first body portion, the spring seat comprising a pair of spaced apart, opposing ears, with opposing gaps provided at the ends of the opposing ears; and

a conductive spring including a base portion removably retained between the opposing ears of the spring seat, the base portion being adapted to extend outward in a radial direction through the

opposing gaps provided between the ears so as to make physical contact with the inner surface of the barrel when the tail cap is engaged with the barrel.

5 56. A tail cap assembly according to claim 55 further comprising a central cavity open to the first end of the first body portion and positioned between the opposing ears of the spring seat, and a spare bulb holder in the central cavity.

10 57. A tail cap assembly according to claim 55, wherein the opposing faces of each ear further include a lip adapted to removably retain the spring.

15 58. A tail cap assembly according to claim 55 further comprising a circumferential channel on the outer periphery of the first body portion adjacent the second end, and a one-way seal in the circumferential channel.

59. A tail cap assembly according to claim 55, wherein the spring comprises a coil spring, and the base portion comprises an oval shaped coil, the minor diameter

of which is removably retained by the spring seat and the major diameter of which extends in a radial direction through the opposing gaps provided between the ears.

60. A tail cap assembly for a flashlight comprising:

5 a tail cap comprising an externally threaded body portion having a first end and a second end, a cap body portion attached to the second end of the threaded body portion, and a spring seat at the first end of the first body portion, the spring seat comprising a pair of spaced apart, opposing ears, with opposing gaps provided at the ends of the opposing ears; and

10 a conductive spring comprising a base portion removably retained between the opposing faces of the ears of the spring seat, the base portion being adapted to extend outward in a radial direction through the opposing gaps provided between the opposing ears.

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61. A tail cap assembly according to claim 60 further comprising a central cavity open to the first end of the threaded body portion and positioned between the opposing

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ears of the spring seat, and a spare bulb holder in the central cavity.

62. A tail cap assembly according to claim 60,
wherein the opposing faces of each ear further include a
5 lip adapted to removably retain the spring.

63. A tail cap assembly according to claim 60 further comprising a circumferential channel on the outer periphery of the threaded body portion adjacent the second end, and a one-way seal in the circumferential channel.

10 64. A tail cap assembly according to claim 60,
wherein the spring comprises a coil spring, and the base portion comprises an oval shaped coil, the minor diameter of which is removably retained by the spring seat and the major diameter of which extends in a radial direction
15 through the opposing gaps provided between the ears.

65. A flashlight comprising:
a barrel for retaining a battery source of power, the barrel having a first and second ends and comprising an electrically conductive material;

a bulb positioned at the first end of the barrel;
a tail cap adapted to removably engage the interior of
the second end of the barrel, the tail cap
including a spring seat positioned on the
interior of the barrel, wherein the spring seat
comprises a pair of opposing ears spaced apart
from the axis of the barrel;
a conductive spring disposed between the tail cap and
a case electrode of the battery source of power,
the conductive spring including a base portion
removably retained between the opposing ears of
the spring seat and being adapted to extend
outward in a radial direction through opposing
gaps provided between the ears so as to make
physical contact with the inner surface of the
barrel when the tail cap is engaged with the
barrel, the spring serving to provide a direct
electrical path between the case electrode of the
battery source of power and the barrel;
an electrical circuit coupling the bulb to the battery
source of power, the electrical circuit including
the direct electrical path; and
a switch interposed in the electrical circuit.

66. A combination comprising:

a lamp bulb secured to a lamp base, the lamp bulb
having a pair of electrodes and a filament
extending between the electrodes, the lamp bulb
being secured to the lamp base so that the center
of the filament is aligned with a predetermined
axis of the lamp base;
a reflector having a principal axis;
a lamp base receiver for receiving the lamp base and
adapted to align the lamp base with the principal
axis of the reflector.

67. A combination according to claim 66, wherein the
lamp base includes a tapered surface concentric about the
predetermined axis, and the tapered surface is seated
against a matching tapered surface provided in the lamp
base receiver and that is concentric about the principal
axis of the reflector.

68. A combination according to claim 66, wherein the
reflector further comprises a central opening, and wherein
the lamp base receiver is adjacent the central opening of

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the reflector so that the lamp bulb extends through the
central opening in the reflector.

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